Incidentally Detected Inferior Vena Cava Anomalies: 3 Case Reports

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ABSTRACT

Objective: Inferior vena cava (IVC) anomalies are very rare vascular embryological variations, the incidence rate in the general population is 0.5%. IVC anomalies are usually asymptomatic and detected incidentally. The inferior vena cava is formed between the 6th and 8th weeks of intrauterine embryological development. IVC occurs due to the fusion of the supracardinal, postcardinal, and subcardinal veins during the embryological period. This union results from complex anastomosis of the embryological stage veins. During this time, various IVC anomalies may develop. IVC anomalies increase the risk of deep vein thrombosis in the lower extremity. Because of the increased risk of deep vein thrombosis in these patients, anti-embolism prophylaxis can be performed before the operation. Therefore, the risk of pulmonary embolism increases as well. The use of computed tomography has become more common nowadays. The detection rate of IVC anomalies has increased in examinations performed for other purposes.

Case: IVC anomalies are important in terms of surgical interventions and the use of a vena cava filter. Knowing the existence of IVC anomalies can be crucial in preventing complications that may arise during surgical and radiological procedures. The objective of this study is to present three different cases with incidentally detected IVC anomalies.

Keywords: Inferior Vena Cava Anomalies; Congenital Vascular Abnormalities; Computed Tomography

INTRODUCTION

Inferior vena cava (IVC) anomalies are vascular anomalies that occur in 0.5% of the general population and develop between the 6th and 8th weeks of embryogenesis (1). If the left renal vein anomalies are also considered, the incidence in the general population increases to 8.7% (2). IVC anomalies do not usually cause a complaint, they are usually asymptomatic and are detected in radiological imaging performed for other reasons. This condition may be accompanied by other congenital anomalies such as asplenia, polyplenia, congenital heart diseases and situs inversus (3). The IVC develops at the 4th week of the embryological period and forms at the 6th and 8th weeks. This development involves anastomosis of the subcardinal, posterior cardinal, and supracardinal veins. It aims to transport venous blood from the lower extremities and abdomen to the heart (4). At the end of this development, the IVC consists of four main parts: intrahepatic, suprarenal, renal, and infrarenal. As a result of advances in cross-sectional imaging in radiology, it has become easier to detect anomalies of the VC and its branches. With the increase in the use of CT in many centers, the frequency of detection of these anomalies in asymptomatic healthy individuals has increased (5).

This study aims to present three incidentally detected IVC anomalies and to emphasize the clinical importance of these anomalies. The first case has an anomaly of the IVC continuous with the azygos vein, without hepatic segment. The second case has double IVC, and the third case has rudimentary IVC.
MATERIAL and METHODS

The examinations were performed with a 64-slice Multidetector Computed Tomography (CT) (Optima CT 660, General Electric Medical Systems, Milwaukee, Wisconsin, USA). Water-soluble nonionic intravenous (iv) contrast material (350 mg/mL) was administered at a dose of 1 ml/kg with an automatic double-injector system at a speed of 4-5 ml/s through an 18-gauge cannula placed in the antecubital vein. IV contrast agent timing was performed with bolus tracking technique.

CASE

Case 1: A 43 years old, male patient was admitted to the general surgery department with the main complaint of abdominal pain. After the abdominal examination, it was found that pain and tenderness was located in the right lower quadrant. In complete blood count and other routine biochemistry tests no pathological finding was detected, with the exception of an elevated CRP count (8.5mg/dL). As a result of the suspicion of a right inguinal hernia, iv contrast multidetector CT examination of the entire abdomen incidentally revealed that there was no hepatic segment of the IVC (Figure 1) and the IVC continued as an enlarged azygos vein in the retrocrural region (Figure 2). Both renal veins were draining into the azygos vein (Figure 3). The azygos and hemiazygos veins were dilated and opened into the superior vena cava (Figure 4 and 5). Except for the left kidney cyst and bilateral inguinal hernia, no pathological finding was detected in another abdominal organ.

Figure 1: Coronal CT section; It was observed that the inferior vena cava did not have a hepatic segment, and it was continuous with the azygos vein of the inferior vena cava.

Figure 2: In the axial thoracic CT section; dilated azygos and hemiazygos vein

Figure 3: Axial CT section; left renal vein draining into azygos vein

Figure 4: Coronal CT section; Dilated azygos vein extending into the superior vena cava
Figure 5: Sagittal CT section; Dilated azygous vein extending into the superior vena cava

Case 2: A 37 years old, male patient who was a kidney transplant donor candidate applied to our clinic. The complete blood count and routine biochemistry tests revealed a high fasting blood sugar due to diabetes and a slight increase in CRP (2.6 mg/dL). In the Multidetector Computed Tomography Angiography (MDCTA) examination, which is routinely applied to kidney transplant patients; a fine-calibrated IVC and a hypoplastic renal vein variation on the left (Figure 6), dilatation in the azygos and hemiazygos veins (Figure 7), and the left renal vein draining through the lumbar vein were incidentally observed (Figure 8). Apart from this, no pathological findings were found in all of the abdominal organs. Approximately 1 month after the diagnosis, the patient developed acute deep vein thrombosis in the lower extremity (Figure 9), and no pulmonary embolism was observed during the follow-up period.

Figure 6: Axial CT sections; Inferior vena cava with a distinctly thinner caliber than normal

Figure 7: Dilated azygos vein in axial CT sections

Figure 8: Left renal vein draining through the lumbar vein in 3-axial CT sections

Figure 9: In the Doppler US examination, no flow was observed in the main femoral vein
Case 3: A 36 years old, male patient applied to our clinic as a kidney transplant donor candidate. Complete blood count and routine biochemical values were normal. In the routine MDBTA examination for kidney transplant; a double IVC was detected incidentally at the infrarenal level (Figure 10 and 11). In addition, a thin lumbar vein joining to the left renal vein was seen (Figure 12). Apart from this, no pathological findings were observed in the abdominal organs.

Figure 10: Axial CT section; double inferior vena cava at the infrarenal level

Figure 11: Double inferior vena cava in coronal CT section

Figure 12: Axial CT section; fine-calibrated lumbar vein draining into the left renal vein

DISCUSSION

IVC is embryologically formed due to anastomoses of three pairs of veins: posterior cardinal, subcardinal, and supracardinal. Various variations may develop as a result of the particular changes in the mentioned developmental stages (1). Having knowledge of the basic embryological steps is essential for an accurate interpretation and diagnosis of vascular anomalies. The IVC consists of four segments: hepatic, suprarenal, renal, and infrarenal.

IVC anomaly that is continuous with the azygos vein can be defined as the supplement of venous return to the superior vena cava through the azygos and hemiazygos veins due to interruption of the IVC below the hepatic vein. This anomaly can be considered as relatively rare in the population, with the reported incidence of %0.5 (1, 5). In radiological imaging, it is important to distinguish dilated azygos veins from right paratracheal and retrocrural lymph nodes or a possible paraspinal mass (6). In rudimentary IVC anomaly; the IVC is found to be finely calibrated and similar to previously mentioned anomaly the renal veins drain into the lumbar or azygos hemiazygos veins. As for double IVC anomaly, a normal localized IVC and a second left paravertebral IVC are seen. Incidence of this particular anomaly is reported as 0.2-3% (1,3).

IVC anomaly was first described in the literature by Abernethy in 1793. His work featured a 10-month-old child with polysplenia and dextrocardia, who had a congenital mesocaval shunt and an IVC anomaly continuous with the azygos vein. Hereafter, with the development and accessibility of cross-sectional imaging, it has become easier to show the anomalies of the IVC and its branches in the asymptomatic population, and the frequency of detection has increased (6,7,8,9).

Inferior vena cava anomalies may be accompanied by cardiac pathologies (10,11), venous thrombus (12) and pulmonary embolism, polysplenia (13) and renal vein anomalies (14,15,16,17,18,19). In accordance with this information, two of our previously mentioned cases presented a clinical picture of renal vein anomalies. As for the other case, deep vein thrombosis in the lower extremity was detected in the Doppler US examination performed 1 month after the diagnosis. None of our cases displayed either pulmonary embolism or polysplenia.

In addition to diagnosis of anomalies, cross sectional imaging also plays an important role in the evaluation of possible secondary pathologies in the cases of previously diagnosed IVC anomalies. Owing to the technical developments in the radiology field, multi-section, three-dimensional, multiplanar images can be obtained in CT, which is a commonly preferred imaging method, as it is easily accessible and non-invasive. Nevertheless, the negative effects of exposure to radiation dose should be considered while using this method. Even though, use of cross-sectional images facilitated the incidental diagnosis in the asymptomatic patients, IVC should also be considered in the presence of unexplained thrombosis in early adulthood, chronic lower extremity venous insufficiency, pulmonary embolism, chronic epigastric, abdominal pain and chest pain.
Knowing the presence of IVC anomalies will be useful in predicting risks such as deep vein thrombosis and pulmonary anomalies that may develop in the individual. However, it will reduce the risk of iatrogenic injury in surgical procedures to be performed in the same anatomy as IVC. It is important to know these anomalies in the management of vena cava filters that are planned to be placed to prevent pulmonary embolism (5, 10).

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